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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/579,837	05/17/2006	Munaf Rahimo	1004501-000844	5756
21839 7590 09/27/2007 BUCHANAN, INGERSOLL & ROONEY PC POST OFFICE BOX 1404 ALEXANDRIA, VA 22313-1404			EXAMINER PATTON, PAUL E	
			ART UNIT 2822	PAPER NUMBER
			NOTIFICATION DATE 09/27/2007	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/579,837	<b>Applicant(s)</b> RAHIMO ET AL.	
	<b>Examiner</b> Paul E. Patton	<b>Art Unit</b> 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 17 May 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 6-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 May 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/17/2006</u> | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Objections***

1. Claims 7-10 are objected to because of the following informalities: the dependent claims refer to claim 1, which has been canceled. Based on the disclosure examiner assumes that claims 7-10 depend on claim 6.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 103***

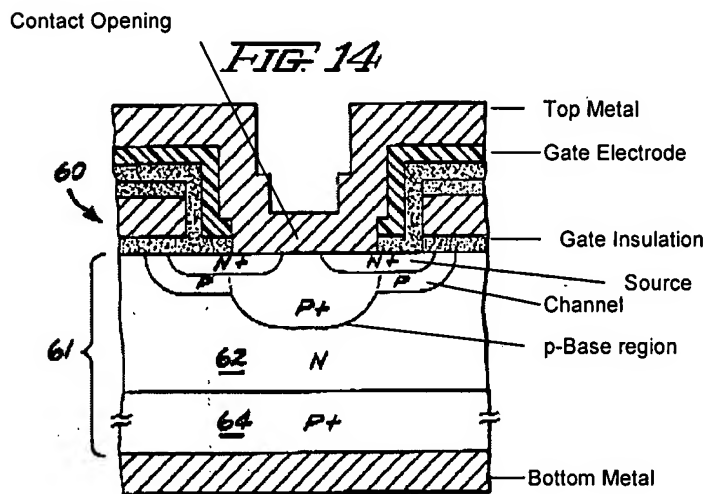
2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baliga et al.,(USPAT 4,443,931) Baliga in view of Fragapane et al.,(EP 1,058,316 A1) Fragapane and further in view of Baliga (US 2004/0099905 A1) Baliga(2).
4. As to claim 6, Baliga discloses and shows (Fig 14) An insulated gate bipolar transistor, comprising: a semiconductor substrate (61) having a top and a bottom surface, a gate insulation film formed on the top surface, said gate insulation film comprising at least one contact opening, said semiconductor substrate comprising • an emitter layer (64) of first conductivity type adjoining said bottom surface, • a drift region (62) of second conductivity type adjoining said emitter layer, • a channel region of first conductivity type with a doping concentration  $P_c$  formed in the drift region underneath the contact opening and underneath part of the gate insulation film, • one or more

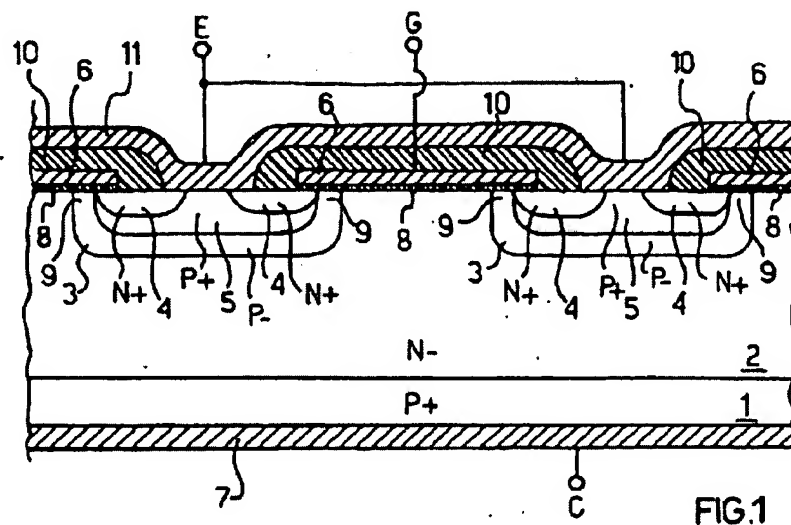
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source regions of second conductivity type disposed in the channel region and delimiting a base contact area; a gate electrode formed on the gate insulation film, a bottom metallization layer formed on the bottom surface, a top metallization layer covering the contact opening and being contacted by one or more source regions, wherein - a first base region of first conductivity type with a doping concentration  $PB1$  is disposed in the channel region so that it encompasses the one or more source regions, wherein - at least one common boundary line on the top surface is formed by the first base region, the one or more source regions and the channel region on the top surface, wherein the doping concentration  $PB1$  of the first base region is higher than the doping concentration  $Pc$  of the channel region..



5. Baliga does not disclose a second base region with a doping concentration  $PB2$  of first conductivity type is confined in the semiconductor substrate to a region underneath the base contact area so that it partially overlaps with the channel region and with the first base region, and wherein - the doping concentration  $PB2$  of the second base region is higher than the doping concentration  $Pc$  of the channel region.

6. Fragapane discloses and shows (Fig 1) a second base region (3) with a doping concentration PB2 of first conductivity type is confined in the semiconductor substrate to a region underneath the base contact area so that it partially overlaps with the channel region and with the first base region.



7. Fragapane is evidence that a person of ordinary skill in the art would find a reason, suggestion or motivation to use a second base region with a doping concentration PB2 of first conductivity type is confined in the semiconductor substrate to a region underneath the base contact area so that it partially overlaps with the channel region and with the first base region.

8. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Baliga by using a second base region with a doping concentration PB2 of first conductivity type is confined in the semiconductor substrate to a region underneath the base contact area so that it partially overlaps with

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the channel region and with the first base region for advantages such as decreasing the flow of holes according to the teachings of Fragapane. (Paragraph [0009]).

9. As to the limitation that the doping concentration PB2 of the second base region and PB1 of the first base region is higher than the doping concentration Pc of the channel region, Baliga (2) is related to similar power transistors and discloses and shows (Fig 15) that the doping of the base region (412) is greater than the doping of the channel region (414).

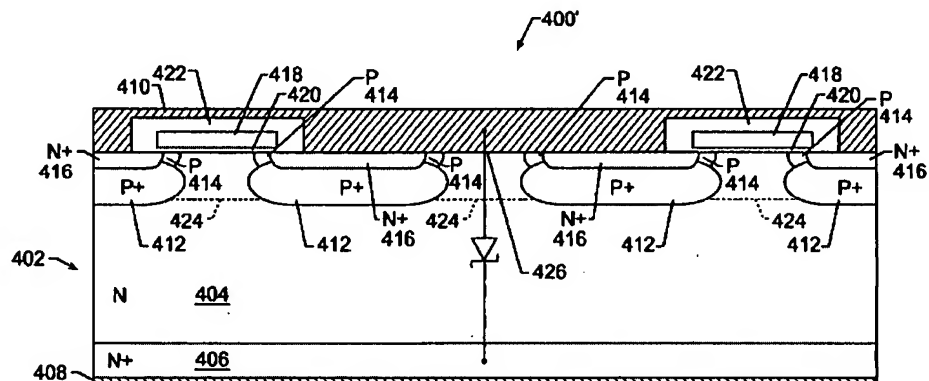


FIG. 15

10. Baliga is evidence that a person of ordinary skill in the art would find a reason, suggestion or motivation to use a doping concentration PB2 of the second base region and PB1 of the first base region higher than the doping concentration Pc of the channel region.

11. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Baliga as modified by Fragapane by using a doping concentration PB2 of the second base region and PB1 of the first base region higher than the doping concentration Pc of the channel region for advantages such as

improved depletion in the drift region according to the teachings of Baliga (Paragraph [0070]).

12. As to claim 7, Baliga as modified by Fragapane and Baliga(2) discloses that the supplementary p- base region depth exceeds the depth of the channel region by more than 1.5. (Column 3, lines 43-46 & Column 4, lines 4-7).

13. As to claim 8, Baliga discloses the claimed invention except for setting the doping level to be 5 times greater. It would have been obvious to one having ordinary skill in the art at the time of the invention was made to set the doping level greater than five times to obtain superior carrier trapping, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

14. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baliga in view of Fragapane and Baliga(2) and further in view of Nakayama (USPAT 5,703,383).

15. Baliga as modified by Fragapane and Baliga(2) does not disclose at least one protection region of a second doping type disposed in the drift region underneath the gate oxide layer, said at least one protection region adjoining both the channel region and the top surface of the semiconductor substrate.

16. Nakayama discloses and shows (Fig 2) at least one protection region (9) of a second doping type disposed in the drift region (1) underneath the gate oxide layer (10), said at least one protection region adjoining both the channel region (3) and the top surface of the semiconductor substrate.

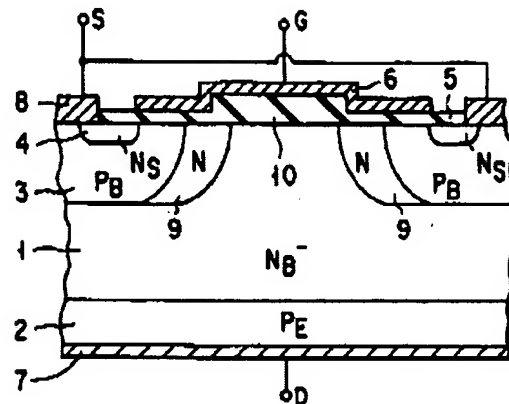


FIG. 2

17. Nakayama is evidence that a person of ordinary skill in the art would find a reason, suggestion or motivation to use a protection region of a second doping type disposed in the drift region underneath the gate oxide layer, said at least one protection region adjoining both the channel region and the top surface of the semiconductor substrate.

18. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Baliga as modified by Fragapane and Baliga(2) by using a protection region of a second doping type disposed in the drift region underneath the gate oxide layer, said at least one protection region adjoining both the channel region and the top surface of the semiconductor substrate for advantages such as lowering the on-voltage of the device according to the teachings of Nakayama. (Column 5, lines 39-42).

19. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Baliga in view of Fragapane and Baliga(2) and further in view of Tomoki (EP 1,227,522).

20. Baliga as modified by Fragapane and Baliga(2) does not disclose the thickness of the gate insulation film increases at a distance / from the contact opening.



21. Tomoki discloses and shows (Fig 14) the gate insulation film (21a and 21b) increases in thickness at a distance from the contact opening.

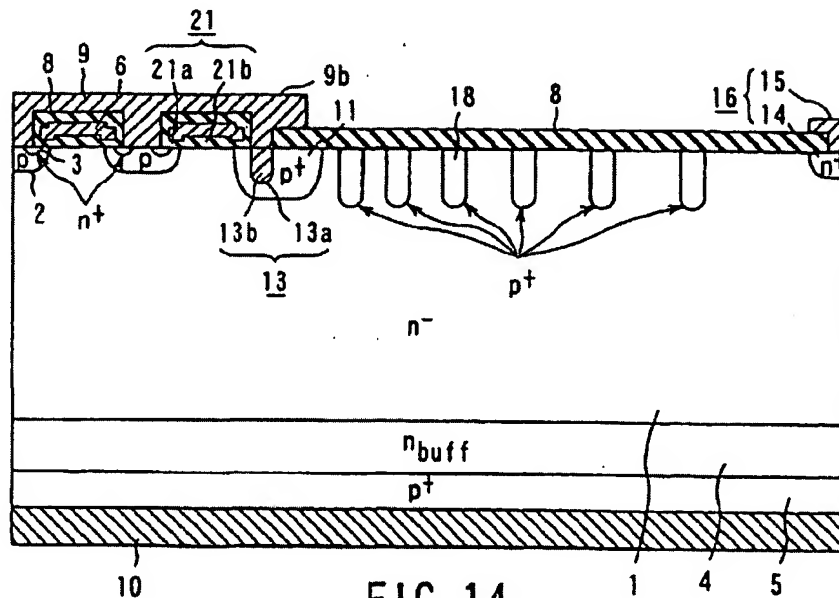


FIG. 14

22. Tomoki is evidence that a person of ordinary skill in the art would find a reason, suggestion or motivation to have the gate insulation film increase in thickness at a distance from the contact opening.

23. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Baliga as modified by Fragapane and Baliga(2) by having the gate insulation film increase in thickness at a distance from the contact opening for advantages such as decreased gate capacitance according to the teachings of Tomiki. (Tomiki, Paragraphs [0062]-[0064]).

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**Conclusion**

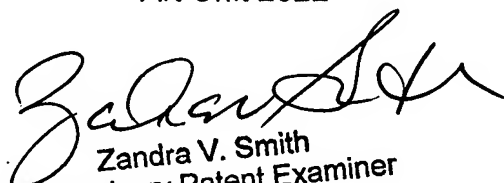
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Paul E. Patton whose telephone number is 571-272-9762. The examiner can normally be reached on 7:00 - 5:30 Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Paul E Patton  
Examiner  
Art Unit 2822

  
PEP

  
Zandra V. Smith  
Supervisory Patent Examiner  
14 Sept. 2007